BAYOU BOEUF TMDL FOR FECAL COLIFORM

SUBSEGMENT 060208

US EPA Region 6

With cooperation from the
Louisiana Department of Environmental Quality
Office of Environmental Assessment
Environmental Technology Division

February 23, 2000

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EXECUTIVE SUMMARY

Section 303(d) of the Federal Clean Water Act requires states to identify waterbodies that are not meeting water quality standards and to develop total maximum daily pollutant loads for those waterbodies. A total maximum daily load (TMDL) is the amount of a pollutant that a waterbody can assimilate without exceeding the established water quality standard for that pollutant. Through a TMDL, pollutant loads can be distributed or allocated to point sources and nonpoint sources discharging to the waterbody. A TMDL has been developed for fecal coliform bacteria for Bayou Boeuf.

Bayou Boeuf flows in a generally southerly direction, to a confluence with Bayou Cocodrie, forming the headwaters of Bayou Courtableau. Bayou Boeuf segment 060208 was listed on both the 1998 and the October 28, 1999 Court Ordered §303(d) Lists as not fully supporting the water quality standard for primary contact recreation (swimming) and was ranked as high priority for TMDL development. Louisiana's water quality standard for protection of the primary contact recreation use reads as follows:

> "Based on a minimum of not less than five samples taken over not more than a 30-day period, the fecal coliform content shall not exceed a log mean of 200/100mL, nor shall more than 10 percent of the total samples during any 30-day period or 25 percent of the total samples collected annually exceed 400/100mL. These primary contact recreation criteria shall apply only during the defined recreational period of May 1 through October 31. During the non-recreational period of November 1 through April 30, the criteria for secondary contact recreation shall apply."

The standard for secondary contact recreation reads similarly: "Based on a minimum of not less than five samples taken over not more than a 30-day period, the fecal coliform content shall not exceed a log mean of 1,000/100 mL, nor shall more than 10 percent of the total samples during any 30-day period or 25 percent of the total samples collected annually exceed 2,000/100 mL."

Five years (January, 1994 – December 1998) of monthly LDEQ monitoring data on Bayou Boeuf (WQ site 104) were assessed to determine if the primary and secondary contact recreation uses were being maintained. Analysis of the data for the November – April season shows that the secondary contact recreation use is being maintained (see Appendix A). Analysis of the data for the May – October season shows that the primary contact recreation use is not protected (see Appendix A). Therefore, a TMDL will be developed to protect the May – October season.

For the purpose of calculating current loading on Bayou Boeuf the average fecal coliform concentration at LDEQ WQ site 104 for the May – October season was calculated using monthly LDEQ monitoring data. In Bayou Boeuf, the monthly fecal coliform counts for this season ranged from 50 cfu/100mL to 5,000 cfu/100mL over the 5-year period (January, 1994-December, 1998).

For the purpose of TMDL development, the criteria of 200/100mL for the May – October season was applied. A TMDL fecal coliform loading curve for this period (May 1 – October 31) has been generated as Figure 1. This TMDL loading curve was developed using Equation 1, substituting the criteria, 200 cfu/100 ml, for FC concentrations and varying flows. The attempt

here is to show that while a TMDL may be expressed as a single point it can also be thought of as a continuum of points representing the criterion value and various flow values.   A 369% reduction in fecal coliform loading during the May – October season will be needed to protect the primary contact recreation use.

1. **Introduction**

Bayou Boeuf segment 060208 was listed on both the 1998 and the October 28, 1999 Court Ordered §303(d) Lists as not fully supporting the water quality standard for primary contact recreation (swimming). Segment 060208 was ranked as high priority (ranking of 1) on the 1998 List. A TMDL for fecal coliform bacteria was developed in accordance with the requirements of Section 303 of the federal Clean Water Act. The purpose of a TMDL is to determine the pollutant loading that a waterbody can assimilate without exceeding the water quality standard for that pollutant; the TMDL also establishes the load reduction that is necessary to meet the standard in a waterbody. The TMDL consists of the wasteload allocation (WLA), the load allocation (LA), and a margin of safety (MOS). The wasteload allocation is the load allocated to point sources of the pollutant of concern, and the load allocation is the load allocated to nonpoint sources. The margin of safety is a percentage of the TMDL that accounts for the uncertainty associated with the model assumptions, data inadequacies, and growth.

2. **Study Area Description**

2.1 Bayou Boeuf, Segment 060208

Bayou Boeuf is located within basin/segment 0602 in south central Louisisna. Bayou Boeuf flows in a generally southerly direction, to a confluence with Bayou Cocodrie, forming the headwaters of Bayou Courtableau. Most of the area of the Bayou Boeuf watershed lies within the natural flood plain of the Red River. The Red River is now leveed, eliminating the potential for a natural flow of water from the River into any of the streams in Segment 0602.

Land use is predominately forest and agriculture with the Alexandria urban area located to the north. Suburban communities have developed in the agricultural lands immediately south and west of Alexandria. The major land uses are listed in Table 1.

Table 1. Land Use (acres) in Segment 0602: Vermilion-Teche Basin

| SEGMENT | AGRICULTURE | URBAN | WETLAND | FOREST |
|---------|-------------|-------|---------|--------|
| 0602 | 6,464 (40.4%) | 589 (3.7%) | 2,638 (16.5%) | 5,499 (34.4%) |

2.2 Water Quality Standards

The designated uses for Bayou Boeuf include both primary contact recreation and secondary contact recreation. Fecal coliform bacteria are the indicator used for the water quality criteria and for assessment of use support. Louisiana's water quality standard for protection of the primary contact recreation use reads as follows:

> "Based on a minimum of not less than five samples taken over not more than a 30-day period, the fecal coliform content shall not exceed a log mean of 200/100mL, nor shall more than 10 percent of the total samples during any 30-day period or 25 percent of the total samples collected annually exceed 400/100mL. These primary contact recreation

criteria shall apply only during the defined recreational period of May 1 through October 31.  During the non-recreational period of November 1 through April 30, the criteria for secondary contact recreation shall apply."

The standard for secondary contact recreation reads similarly: "Based on a minimum of not less than five samples taken over not more than a 30-day period, the fecal coliform content shall not exceed a log mean of 1,000/100 mL, nor shall more than 10 percent of the total samples during any 30-day period or 25 percent of the total samples collected annually exceed 2,000/100 mL."

2.3  Identification of Sources

The sources identified in the *1998 Louisiana Water Quality Inventory* as affecting the water quality of Bayou Boeuf are designated as "Other" (natural sources).

Point Sources

There are 30 permitted facilities (with known flow information) discharging sanitary wastewater into Bayou Boeuf and its tributaries.  The combined flow of all these discharges is 974,370 gallons per day (See Appendix B).

Nonpoint Sources

The predominant land uses along the Bayou Boeuf are agriculture and forestry, both of which can contribute to fecal coliform loads through runoff.

3.  **TMDL Load Calculations**

3.1 Current Load Evaluation

Fecal coliform loads have been calculated using the instream bacterial counts and the flow of the stream.  The following equation can be used to calculate fecal coliform loads.

Equation 1.  C x 1000mL/ L x 1 L/0.264 gallons x Q in gallons/day = cfu/day

Where:   C = colony forming units/100mL
            Q = stream flow in gallons/day

A traditional expression of the FC loading may be developed by setting one critical or representative flow and concentration, and calculating the fecal coliform load using Equation 1. The difficulty with this approach is in the determination of the appropriate flow or concentration value to use.  For the purpose of calculating current loading on the this waterbody the average fecal coliform concentration for the May-October season was calculated using monthly LDEQ monitoring data on Bayou Boeuf (WQ site 104). WQ site 104 was used because of its multiple years of fecal coliform data.  In Bayou Boeuf, the monthly fecal coliform counts for this season ranged from 50 cfu/100mL to 5,000 cfu/100mL over a 5-year period (January, 1994-December, 1998).  The average fecal coliform count for the May – October season is 937 cfu/100ml (see Appendix A).  In addition, the average flow for Bayou Boeuf, for the May – October season is

165 ft$^3$/sec (see Appendix C). Using these values and Equation 1 it is estimated that the current loading for the May – October season is 3.78E12 cfu/day.

3.2  TMDL

Point sources usually have a defined critical receiving stream low flow such as the 7Q10 at which the criterion must be met. For nonpoint sources it is recognized that there may be no single critical flow condition. To address this condition, a TMDL fecal coliform loading curve for the recreational period (May 1 – October 31) has been generated as Figure 1. This TMDL loading curve was developed using Equation 1, substituting the criteria, 200 cfu/100 ml, for FC concentrations and varying flows. The attempt here is to show that while a TMDL may be expressed as a single point it can also be thought of as a continuum of points representing the criterion value and various flow values. This curve is not stream dependent but is dependent upon the designated stream criterion. Therefore, it may be applied to any stream with a like FC criterion. This curve represents the TMDL loading allocation for FC.

Figure 1. TMDL Fecal Coliform Loading Curve for the May – October season.
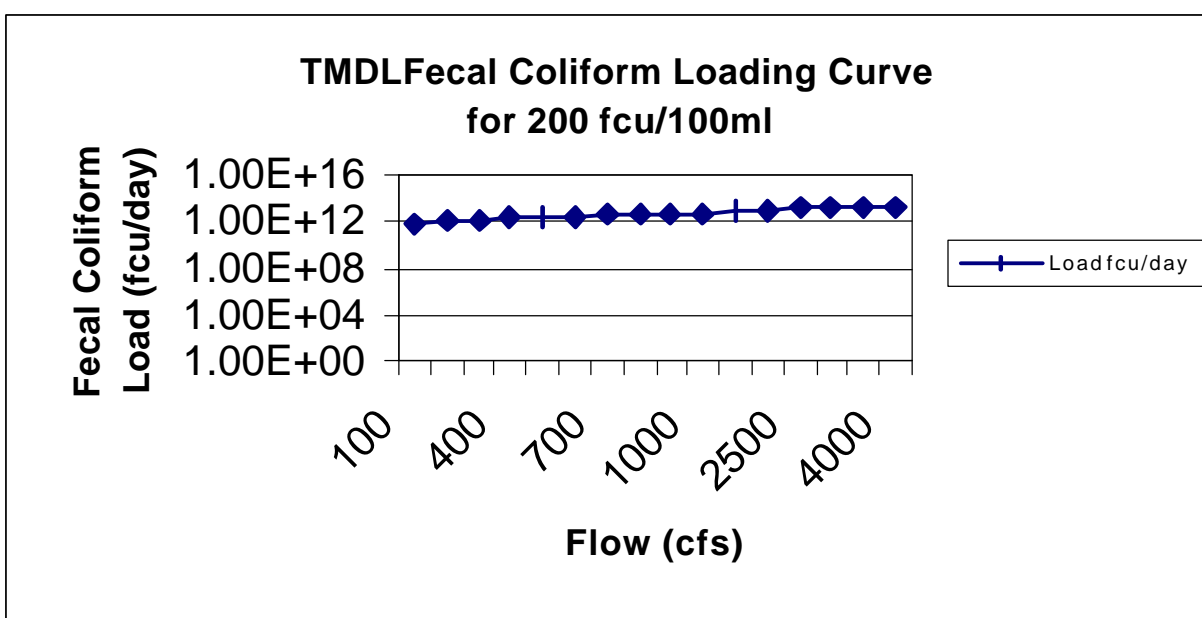


Utilizing Figure 1 one can select a stream flow and can quickly determine the FC loading value. The line formed by this series of points may be thought of as a boundary. At any given flow the loading may be below the line, within the boundary, or above the line. FC load values falling above the line represent disproportionately high values relative to the standard. FC load values falling below the line represent low loads relative to the standard. To develop load reductions one simply needs to determine the appropriate flow value (x-axis) and see where it intersects the load allocation line.

The load reduction needed to meet the water quality standard for primary contact recreation in Bayou Boeuf at 165 cfs is 2.97 E12 cfu/day (369% reduction). This was obtained by calculating

the allowable TMDL at 165 cfs for the 200 cfu/100ml criterion (8.06 E11 cfu/day) and subtracting this load from the observed load (3.78 E12 cfu/day, see Appendix A).

Current Load - TMDL = Load Reduction

3.78 E12 cfu/day – 8.06 E11 cfu/day  = 2.97 E12 cfu/day

3.3 Wasteload Allocation (WLA)

The Louisiana Water Quality Regulations require permitted point source discharges of treated sanitary wastewater to maintain a fecal coliform count of 200cfu/100ml in their effluent, i.e., they must meet the standard at end-of-pipe.  Therefore, there will be no change in the permit requirements based upon a wasteload allocation resulting from this TMDL.

Equation 1 can be used to calculate the total point source load (wasteload allocation) utilizing a fecal coliform count of 200cfu/100ml and the total volume of all the wastewater dischargers (974,370 gallons/day).

> 200 cfu/100mL * 1000mL/L * 1 L/0.264 gallons * Q gallons/day = WLA

> Where Q = Total volume of sanitary wastewater discharges into Vermilion River

> WLA for all dischargers = 7.38 E9 cfu/day

3.4  Load Allocation (LA)

The load allocation for each season for a given flow can be calculated using Equation 1 and the following relationship:

(TMDL@ given flow and criterion) - (WLA)= LA

> LA for May – October season at an instream flow of 165 cfs  = 7.98 E11 cfu/day

> 8.06 E11 cfu/day (TMDL@ 165 cfs) – 7.38 E9 cfu/day (WLA) = 7.98 E11 cfu/day

3.5 Seasonal Variability

Louisiana has established a seasonal water quality standard for bacteria based upon definition of a summer swimming season and winter secondary contact only.  In development of this TMDL data for all seasons were evaluated and it was determined that a TMDL for the May - October season was needed to protect the primary contact recreation use.

3.6 Margin of Safety (MOS)

The Clean Water Act requires that TMDLs take into consideration a margin of safety.  EPA guidance allows for the use of implicit or explicit expressions of the margin of safety or both.

When conservative assumptions are used in the development of the TMDL or conservative factors are used in the calculations, the margin of safety is implicit. When a percentage of the load is factored into the TMDL calculation as a margin of safety, the margin of safety is explicit. In this TMDL for fecal coliform, conservative assumptions have been used and therefore, the margin of safety is implicit. These conservative assumptions are:

- Using average seasonal flows to calculate current loading to obtain load reduction.
- Treating fecal coliform bacteria as a conservative pollutant, that is, a pollutant that does not degrade in the environment (bacteria do die off in the environment)
- Using the more conservative 200 cfu/100mL standard rather than 400 cfu/100mL for the summer primary contact recreational season.
- Using the design flow of the point source dischargers rather than actual average flow rates, which are typically much lower

## 4   Implementation Plan

Point source discharges will be permitted with a requirement to meet the bacteria standard of 200/100mL in their effluent through the LPDES program. When a discharger is found to be out of compliance with the permit requirement, enforcement action follows.

The nonpoint source loading will be addressed through the LDEQ Nonpoint Source Management Program. This will involve LDEQ working with other stakeholders to identify where best management practices (BMPs) may be needed to control sources of fecal coliform bacteria and which BMPs should be implemented. The LDEQ will also work with stakeholders such as local groups and government officials and the Cooperative Extension Service to implement education programs to inform the local citizenry about proper installation and maintenance of septic systems and animal waste management on their rural home sites. Cooperative efforts among stakeholders and public outreach and education will be essential in the implementation of this TMDL to control man-induced nonpoint sources of fecal coliform pollution.

## 5   Monitoring Plan

Utilizing funds under Section 106 of the federal Clean Water Act and under the authority of the Louisiana Environmental Quality Act, the LDEQ has established a program for monitoring the quality of the state's surface waters. The LDEQ Surveillance Section collects surface water samples at various locations, utilizing appropriate sampling methods and procedures for ensuring the quality of the data collected. The objectives of the surface water monitoring program are to determine the quality of the state's surface waters, to develop a long-term data base for water quality trend analysis, and to monitor the effectiveness of pollution controls. The data obtained through the surface water monitoring program is used to develop the state's biennial 305(b) report (*Water Quality Inventory*) and the 303(d) list of impaired waters. This information is also utilized in establishing priorities for the LDEQ nonpoint source program.

The LDEQ has implemented a watershed approach to surface water quality monitoring. Through this approach, the entire state is sampled over a five-year cycle with two targeted basins sampled each year. Long-term trend monitoring sites at various locations on the larger rivers and Lake

Pontchartrain are sampled throughout the five-year cycle. Sampling is conducted on a monthly basis or more frequently if necessary to yield at least 12 samples per site each year. Sampling sites are located where they are considered to be representative of the waterbody. Under the current monitoring schedule, targeted basins follow the TMDL priorities. In this manner, the first TMDLs will have been implemented by the time the first priority basins will be monitored again in the second five-year cycle. This will allow the LDEQ to determine whether there has been any improvement in water quality following implementation of the TMDLs. As the monitoring results are evaluated at the end of each year, waterbodies may be added to or removed from the 303(d) list. The sampling schedule for the first five-year cycle is shown below. The Vermilion-Teche River Basin will be sampled again in 2003.

> 1998 – Mermentau and Vermilion-Teche River Basins
> 1999 - Calcasieu and Ouachita River Basins
> 2000 – Barataria and Terrebonne Basins
> 2001 – Lake Pontchartrain Basin and Pearl River Basin
> 2002 – Red and Sabine River Basins

> (Atchafalaya and Mississippi Rivers will be sampled continuously.)

In addition to ambient water quality sampling in the priority basins, the LDEQ has increased compliance monitoring in those basins, following the same schedule. Approximately 1,000 to 1,100 permitted facilities in the priority basins were targeted for inspections. The goal set by LDEQ was to inspect all of those facilities on the list and to sample 1/3 of the minors and 1/3 of the majors. During 1998, 476 compliance evaluation inspections and 165 compliance sampling inspections were conducted throughout the Mermentau and Vermilion-Teche River Basins.

## 6   Public Participation

When EPA establishes a TMDL, 40 C.F.R. § 130.7(d)(2) requires EPA to publicly notice and seek comment concerning the TMDL. Pursuant to an October 1, 1999, Court Order, EPA prepared this TMDL. After submission of this TMDL to the Court, EPA will commence preparation of a notice seeking comments, information and data from the general and affected public. If comments, data or information are submitted during the public comment period, then the Court Ordered TMDL may be revised accordingly. After considering public comment, information and data, and making any appropriate revisions, EPA will transmit the revised TMDL to the Court, and to the Louisiana Department of Environmental Quality (LDEQ) for incorporation into LDEQ's current water quality management plan.

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**NOTE:  For copies of appendicies please contact Ellen Caldwell, EPA Region 6, 1445 Ross Avenue, Dallas, Texas  75202 or call (214) 665-7513.**

APPENDIX A

Fecal Coliform data and loading calculations for each season.

APPENDIX B

Dischargers in subsegment.

APPENDIX C

Flow calculation methodology.